Marine Environmental Specimen Bank Activities

NIST continues the expansion of its environmental specimen banking activities through the Marine Environmental Specimen Bank (Marine ESB) at the Hollings Marine Laboratory, Charleston, SC. With the increased interest in newly emerging contaminants, the Marine ESB will be a valuable resource for establishing temporal trends for these compounds in marine ecosystems. The banking of marine mammal tissues for chemical analysis continues and now includes the routine banking of plasma, whole blood, blubber biopsies, and milk collected as part of ongoing bottlenose dolphin population health studies and samples collected during Unusual Mortality Events (UMEs). The Marine ESB continues the banking of bird specimens collected as part of two Department of Interior bird monitoring programs. During 2005, banking for Mussel Watch was reinstituted at the request of the National Oceanic and Atmospheric Administration (NOAA). Also during 2005, ties were developed with a specimen bank program being established in France, the ESB Observatoire de Recherche sur la Qualité de l'Environnement (ORQUE) Project initiated by the State of Aquitaine, University of Pau. Although development of a genetic cryobank for marine research is still in the future plans for the Marine ESB, priority is being given to planning the design and development of a marine mammal cell-line bank for immunological research and a serum bank for marine animal disease research.

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Environmental specimen banking is the long-term preservation of representative environmental specimens for deferred analysis and evaluation. A systematic well-designed specimen bank program is not only a valuable component of real-time monitoring and basic research, but it also enables investigators to extend their research into the past and provides for future verification of analytical results. Formal environmental specimen banks are recognized internationally as integral parts of long-term environmental monitoring and research. Two national environmental banking systems in the US are the CDC and the Agency for Toxic Substances and Disease Registry (ATSDR) Specimen Packaging, Inventory and Repository (CASPIR™), which cryogenically archives specimens for national public health investigations, and NIST's National Biomonitoring Specimen Bank (NBSB) which cryogenically archives specimens for environmental research. Both specimen banks include well developed banking protocols, computerized sample tracking (chain-of-custody) systems, maintenance of many forms of data associated with original specimens, and large investments in state-of-the-art facilities and equipment required to store specimens over relatively long periods of time. Both programs have emphasized cryogenic storage, using ultra-cold (-80 °C) electric freezers and liquid nitrogen vapor storage (-150 °C), security systems, and monitoring of storage conditions 24 hours a day, 365 days a year.

The NBSB was originally established in 1979 by NIST at its Center for Neutron Research. In 2002, a NBSB satellite facility was established by NIST at the Hollings Marine Laboratory, Charleston, South Carolina. This facility, the Marine Environmental Specimen Bank (Marine ESB) is devoted to the cryogenic banking of environmental specimens collected as part of ongoing research and monitoring programs in the marine and coastal environment of the US conducted by other agencies, such as the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of the Interior (DOI).

The establishment of the Marine ESB at the Hollings Marine Laboratory in association with NOAA, two institutions of higher learning and research, and a State marine research laboratory, has provided major resources and support for expansion of specimen banking for marine research nationwide. The National Marine Mammal Tissue Bank, which was established by federal legislation in 1992, is maintained by NIST for the National Marine Fisheries Service and the Fish and Wildlife Service as a component of the NBSB and Marine ESB, with the Marine ESB providing the lead. Tissue samples for banking are collected from single stranded animals, mass strandings, animals incidentally taken in commercial fishing operations, as part of unusual mortality event investigations, from Alaska Native

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subsistence hunts, and as part of ongoing live-capture and release studies of marine mammal population health. NIST maintains 3,200 tissue samples collected from 885 individuals representing 37 species of marine mammals from throughout the U.S. coastal waters, including Alaska. Since establishing the Marine ESB, NIST has used its banking expertise to develop protocols and to collect and archive blood and blubber samples for NOAA's ongoing bottlenose dolphin health assessment studies, to collect eggs as part of a DOI environmental monitoring program on Alaska seabird colonies, and to collect eggs and feathers as part of a DOI peregrine falcon monitoring program. To date, blood and blubber have been collected from 215 bottlenose dolphins, 680 eggs have been archived from five species of arctic seabirds throughout Alaska, and 68 samples of eggs and feathers have been collected from the peregrine falcon program.

From 1985 until 1992, the NBSB provided for the banking of fish tissues, sediments, and mussels and oysters as part of the NOAA's National Status and Trends Program. This banking ended in 1992 when funding support ended. Realizing the value of the banking component of this program, some funding was restored and banking of mussels and oysters began again in 2005, with the lead being provided by the Marine ESB. Also during 2005 through information and staff exchanges, ties were developed with a specimen bank program being established in France, the ESB *Observatoire de Recherche sur la Qualité de l'Environnement* (ORQUE) project initiated by the State of Aquitaine, University of Pau. In 2006, ties will be strengthened with the ESB ORQUE project with possibly additional staff exchanges.

The primary function of the Marine ESB is to provide samples for retrospective analysis. A major effort by NOAA at the HML, involves the identification and investigation of newly emerging contaminants of concern in the marine environment. The specimens archived in the Marine ESB will provide a valuable resource for investigating temporal environmental trends in these new compounds and for determining patterns of past exposure in marine biota. Some of this work has begun. A paper investigating the temporal trends in two brominated flame retardants, polybrominated diphenyl ethers (PBDEs) and hexabromochlorododecane (HBCD), using California sea lion tissues from the specimen bank was published in 2005. In addition, analyses are in progress on marine mammal and seabird specimens from the specimen bank as part of an effort to establish baseline data on organotin compounds in these specimens and to identify geographic and temporal trends for coastal areas of the U.S.

Impact: Establishing the Marine ESB in association with the Hollings Marine Laboratory has provided a renewed interest in specimen banking as part of marine environmental monitoring and health research. Additional kinds of specimens have been added to the bank and additional sponsors have contributed to the expansion of the banking program. With the recognition that newly emerging compounds are appearing in the environment with potential environmental and health effects, the value of the specimens presently held by the bank for determining past exposure patterns and for evaluating temporal trends in concentrations of these compounds is becoming very apparent.

Priority will be given in 2006 to establishing a marine mammal cell-line bank and to incorporate a serum bank for marine animal disease research as part of the Marine ESB. Establishing a genetic cryo-bank as part of a National Genetics Archive initiate for marine biota is still being planned for the future.

Future Plans: NIST will continue to work with the Hollings Marine Laboratory partners and other federal agencies and partners to expand environmental specimen banking. NIST is working with these partners to add banking as part of a future sea turtle health assessment program. Existing specimens being held by the NBSB and Marine ESB are being identified for future work on identifying and measuring new contaminants of interest as related to issues on ocean and human health.